FOXBORO®

Product Specifications **PSS 2C-1B3 A**

I/A Series® 1/8 DIN Temperature Controllers

Models 718TC with mA Output and 718TS with Servo Output

The Foxboro 718T Series are powerful compact, 1/8 DIN, microprocessor-based temperature controllers. They offer a variety of standard features commonly found only as options with our competitors. As symbolized by the “CE” Logo marking on the product, these controllers conform to the applicable European Union directives.

The 718T Series expands the capability of standard 1/8 DIN controllers with advanced features, such as Modbus serial communication to I/A Series for Windows NT, where data collection capabilities and remote operation are needed, Adaptive Auto-Tune for quick start-ups, and Anti-Windup for keeping your batch process under control.

The NEMA 4X faceplates allow these units to be used in applications where washdowns and dust conditions exist.

The Soft Start function prevents thermal shock.

Designed specifically for equipment manufacturers who need communications to data acquisition equipment, the light and compact (1/8 DIN size) is able to perform in the most demanding applications with easy yet reliable control.

The 718T Series start-up is as simple as

- wiring the instrument
- configuring set points and alarm thresholds
- initiating the autotune function

Engineers, technicians, and operators, skilled or unskilled in process control theory, can obtain perfect process control.

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A Siebe Group Company

FEATURES

- Dual 4-digit LED display
- Universal input (T/C, RTD, mV, V, mA)
- Auto-tuning, SMART adaptive tuning
- Time proportional control
- Two-ramp function
- Anti-windup protection
- NEMA 4X
- 100 to 240 V ac switching power supply
- Algorithms for heat or heat/cool control
- Four independent set points selectable from external input contact (718TC only)
- Up to four outputs, one analog and three relay outputs
- Up to three independent alarms relay outputs configurable with automatic or manual reset
- 0-20 mA or 4-20 mA output (718TC only)
- Transmitter power supply
- Output “Turn Off” function, turns off the output and allows the controller to operate as an indicator

OPTIONAL FEATURES

- Opto-isolated RS-485 serial communication interface with Modbus
- Instrument configurable by keyboard or through serial link
- 24 V ac/V dc supply

Auto-Tuning and Self-Tuning Function

During start-up, the SMART algorithm implements the self-tuning function, calculating the values of the PID parameters in order to optimize the set point approach and decrease overshoot. The advantage of this self-tuning algorithm is the ability to operate without injecting any artificial change into the system. See Figure 1.

During control, the SMART algorithm dynamically adapts the PID parameters to set point or load changes.

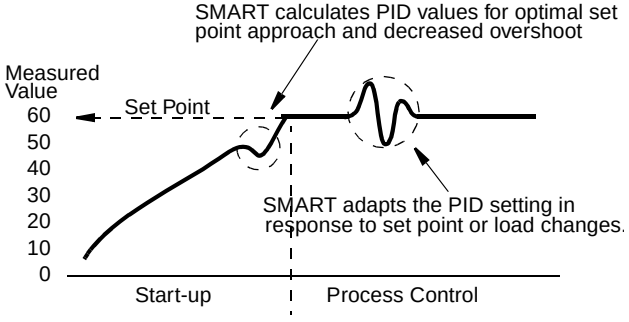


Figure 1. Quick Start-Ups with SMART Adaptive Self-Tuning

Ramp Function

There are two independent ramps (ramp up and ramp down) for set point changes (see Figure 2). Some processes require a ramp to reach a new set point value. Often the temperature process may need a fast ramp rate for heating and a slow ramp rate for cooling. Independent ramps can be applied to both set points.

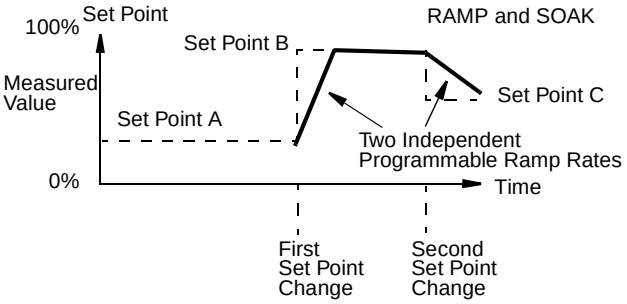


Figure 2. Two Independent Ramp Functions for Set Point Changes

Precise Measurement Readings with Offset

In many applications, offset is needed to adjust the measured variable for physical differences which affect the signal received by the controller. In some cases, the sensor is not located in the ideal position, which may produce a measurement error. A constant offset can be configured to compensate for the error.

Start-Up and Operation with Soft Start

Implementing Soft Start in heating and cooling processes can avoid thermal shock and increase the heater life. The Soft Start function enables gradual preheating of the controlled process; simply program the output and time duration to be used during preheating phase. See Figure 3.

The Soft Start function can limit the rate of output change for infinite duration, helping to ensure that the process will operate in a safe condition.

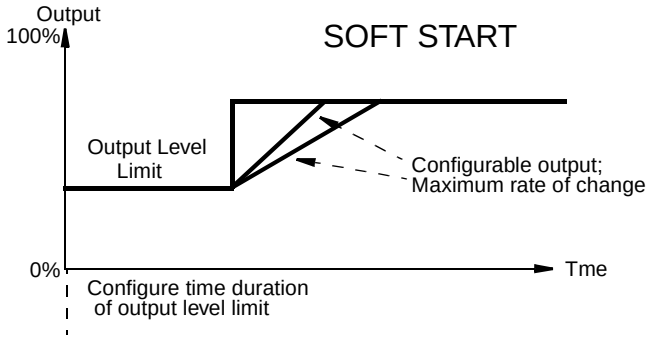


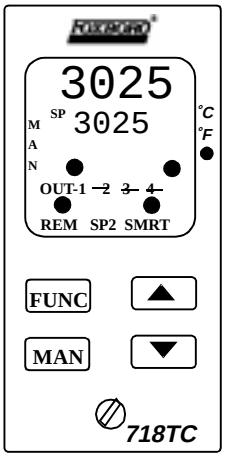
Figure 3. Assurance of Safe Start-Ups

Computer Interface

- Provides two types of protocol, RS-485 with Modbus or Jbus.
- Communicate to small system using Foxboro I/A Series system for Windows NT.

DDE interface to Windows-based applications. Provides an integration tool for applications running under Windows. DDE makes data available to your application. The data can then be processed for trending, SPC, data storage, or man/ machine Interface. To order, see Model Code.

Operator Interface



Configuration Tool

Configure the 718T Series with any PC running MS-DOS 5.0 or higher. The configuration tool easily organizes your applications storing all configuration data for quick start-ups. To order, see Model Code.

Upper Display
Shows the actual measured value or (during configuration) the value of the selected parameter.

Lower Display
Shows the operating set point, the output level, and the abbreviated name of the selected parameter.

See below for descriptions of the displays.

Button	Description
▼	Decreases the selected parameter.
▲	Increases the selected parameter.
FUNC	Displays in sequence all parameters and saves the new settings or displays the output level and heater current.
MAN	Switches from auto to manual mode and vice versa.
▼ + ▲	Starts the default parameters loading procedure.
▲ + FUNC	Enables/disables the output power OFF function.

Indicator	Description
REM	Instrument is under control of digital communications.
SP	Indicates set point value.
SP2	Flashes at a slow rate when SP2 is used. Flashes at a faster rate when a set point from digital communications is used.
SMRT	Flashes during start-up auto-tuning. Lit steadily during adaptive auto-tuning.
MAN	Instrument operating in manual mode.
°C/°F	For TC or RTD input, one of these indicators is lit to show selected units.
OUT1	Flashes proportionally with Output 1.
OUT2	Lit when Output 2 is ON or Alarm 1 is in the alarm state.
OUT3	Lit when Output 3 is ON or Alarm 2 is in the alarm state.
OUT4	Lit when Alarm 3 is in alarm condition.

STANDARD SPECIFICATIONS

Housing
ABS black. Self-extinguishing degree V-O according to UL, VDE, and CSA.

Agency Certification
These controllers have been designed to meet the safety standards of CSA, UL, and CE. For detailed information, or status of testing laboratory approvals/certifications, contact Foxboro.

Front Protection
Designed and tested for IP65 and NEMA 4X for indoor locations (when panel gasket is installed)

Installation
Panel mounting by means of brackets

Rear Terminal Block
Up to 21 screw terminals, with safety rear cover

Dimensions
48 x 96 mm (1.890 x 3.780 in) per DIN 43700; 116 mm (4.567 in) deep

Mass
400 g maximum (1 lb)

Power Supply (Switch Mode)
100 to 240 V ac, 50/60 Hz (+10% to -15% of the nominal value)

Power Consumption
11 VA

Insulation Resistance
>100 Megohms per IEC 348

Isolation Voltage
1500 Vrms per IEC 348

D/A Conversion
Dual slope integration

Noise Immunity
- Electrical fast transient/burst requirements: Severity Level 3 (per IEC 801-4)
- Electric discharge requirements: Severity Level 3 (per IEC 801-2)

Sampling Time
250 ms for linear inputs.
500 ms for TC or RTD inputs

Accuracy
±.2% full scale value at 25 °C and nominal power supply voltage

Common Mode Rejection Ratio
120 dB at 50/60 Hz

Normal Mode Rejection Ratio
60 dB at 50/60 Hz

Normal Operating Temperature Limits
0 to +50 °C (32 to 122 °F)

Storage Temperature Limits
-20 to +70 °C (-4 to +158 °F)

Relative Humidity Limits
20% to 85%, noncondensing

Protection
- Watchdog for automatic reset
- DIP Switches for configuration and calibration parameters

Universal Analog Input
All inputs are factory calibrated and selectable from the keyboard, configurable as one of three types.
THERMOCOUPLE TYPES
J, K, L, R, S, and N are keyboard configurable.
Engineering Units
°C and °F keyboard configurable
Sensor Break
Downscale or upscale programmable. On RTD inputs, an overrange is indicated when input resistance is less than 15 Ω (short circuit sensor detection).
Reference Junction
Automatic compensation for an ambient temperature between 0 and 50 °C
Reference Junction Drift
0.1/°C
Input Impedance
>1MΩ
Calibration
Per IEC 584-1

STANDARD SPECIFICATIONS (Continued)

Standard Ranges

TC Type	Range
B (718TS only)	0/1820.0 °C
L	0/400.0 °C
L	0/900 °C
J	0/400.0 °C
J	0/1000.0 °C
K	0/400.0 °C
K	0/1200.0 °C
N	0/1400.0 °C
R	0/1760.0 °C
S	0/1760.0 °C
T	0/400.0 °C
B (716TS only)	0/3310.0 °F
L	0/1650.0 °F
J	0/1830.0 °F
K	0/2190.0 °F
N	0/2550.0 °F
R	0/3200.0 °F
S	0/3200.0 °F
T	0/750 °F

NOTE

For TC inputs, the minimum span is 300 °C or 600 °F, which makes it possible to increase the sensitivity of the control parameters.

RTD INPUT

RTD Type

Pt 100Ω 3-wire connection

Calibration

Per DIN 43760

Line Resistance

Maximum of 20 ohms/wire with no appreciable error

Engineering Units

°C and °F, keyboard configurable

Sensor Break Detection

Open sensor (one or more open wires), and short circuit sensor detection

Standard Ranges

°C	°F
-199.9/400	-330/750
-200/800	-330/1470

NOTE

For RTD inputs, the minimum span is 100 °C or 200 °F, which makes it possible to increase the sensitivity of the control parameters.

LINEAR INPUTS

mA dc Input (Standard)

0-20 mA dc and 4-20 mA dc keyboard configurable

Input Impedance
<5 Ohm

V dc Input

0-5 V dc and 1-5 V dc configurable; input impedance: >200K Ohm

0-10 V dc and 2-10 V dc configurable; input impedance: >400K Ohm

0-60 mV dc and 12-60 mV configurable; input impedance: >1M Ohm

Read-out

Keyboard configurable from -1999 to 4000

Decimal Point

Configurable to any position

Standard Ranges

Input	Impedance
0-20 mA	<5 Ω
4-20 mA	<5 Ω
0-60 mV	>1 MΩ
12-60 mV	>1 MΩ
0-5 V	>200 kΩ
1-5 V	>200 kΩ
0-10 V	>400 kΩ
2-10 V	>400 kΩ

AUTO/MANUAL Mode

Selectable by front pushbutton

AUTO/MANUAL Transfer

Bumpless

STANDARD SPECIFICATIONS (Continued)

Outputs

LOGIC VOLTAGE FOR SSR DRIVER (Output 1 only)

Logic Level 0

V out <0.5 V dc

Logic Level 1

14 V dc ±20% at 17 mA maximum
24 V dc ±20% at 1 mA maximum

Output Safety Value

When the instrument detects an out of range or a sensor break condition, it can force the output to a configurable safety value.

OUTPUT DISABLE FUNCTION

This function disables the control output allowing the instrument to operate as an indicator. When control is resumed, “turn off” is disabled and the instrument will operate as follows: the integral component of the output signal will be set to zero, the soft start function will be enabled, and the alarm masking function will be enabled.

Alarms

This instrument is equipped with two independent Alarm Relay outputs configurable as:

- Heating + Alarm 1 + Alarm 2
- Heating + Cooling + Alarm 1

An optional fourth output is available as Alarm 3 (718TC only).

OUTPUT ACTION

Direct or reverse function configurable

ALARM FUNCTIONS

Each alarm can be configured as process alarm, band alarm, or deviation alarm.

ALARM MASKING

Each alarm can be configured as a masked or standard alarm. Alarm masking allows suppression of alarm indicators at start-up and after a set point change.

ALARM RESET

Automatic or manual reset programmable on each alarm

ALARM INDICATIONS

Two indicators show when the respective alarm is on.

ALARM OUTPUTS

Two SPST relays. Contact rated at 2 A, 250 V ac on resistive load.

PROCESS ALARM

Operating Mode

Configurable, high or low

Alarm Set Point

Configurable in engineering units within the entire range

Hysteresis

Configurable from 0.1% to 10.0% of the input span

BAND ALARM

Operating Mode

Inside or outside band configurable

Alarm Set Point

Configurable from 0 to 500 units

Hysteresis

Configurable from 0.1% to 10.0% of the input span

DEVIATION ALARM

Operating Mode

High or low configurable

Alarm Set Point

Configurable from –500 to +500 units

Hysteresis

Configurable from 0.1% to 10.0% of the input span

Digital Communications (Optional)

TYPE

RS-485

PROTOCOL TYPE

Modbus, Jbus

BAUD RATE

Keyboard configurable from 600 to 19200 baud

BYTE FORMAT

7 or 8 bit configurable

PARITY

Even, odd, or none configurable

STOP BIT

One

ADDRESS

From 1 to 255 for all other protocols

OUTPUT VOLTAGE LEVELS

Per EIA standards

718TC Specifications

Outputs (Four Output Types Standard)

OUTPUT 1 TYPE

Opto-isolated 0-20 mA or 4-20 mA configurable

Function

Programmable as:

– control output (heating or cooling)
– retransmission of the measured value
– retransmission of the operating set point

Scaling

Configurable from -1999 to 9999

Maximum Load

500 Ω

Resolution

– 0.1% when used as control output
– 0.05% when used as analog retransmission

Digital Filter

Digital filter available for retransmission output (with same time constant as the readout)

Output Level Indication (as control output only)

From 00.0 to 100.0%

Output Status Indication

The OUT 1 indicator flashes with a duty cycle proportional to the output level.

OUTPUT 2 TYPE

SPST relay contact (NO or NC selectable by jumper) with rated current of 3 A at 250 V ac on a resistive load

Function

Configurable as:

– Control output (heating or cooling)
– Alarm 1 output

OUTPUT 3 TYPE

Relay with SPST contact with rated current 2 Amps at 250 V ac on resistive load

Function

Configurable as:

– Control output (heating or cooling)
– Alarm 2 output

OUTPUT 4 TYPE

Relay with SPST contact with rated current 2 Amps at 250 V ac on resistive load

Function

Configurable as Alarm 3 output

LOGIC VOLTAGE FOR SSR DRIVE

Logic status 1: 24 V +20% at 1 mA;
14 V +20% at 20 mA
Logic status 0: <0.5 V

CURRENT OUTPUT

This output is configurable as a control output or as a retransmission output of either the measured value or the control setpoint. This is an isolated output with a maximum load of 500 Ω .

Logic Inputs

The 718TC is equipped with two logic inputs used to select between as many as four set points (SP, SP2, SP3, SP4).

For logic inputs, use an external contact with a contact rating of at least 0.5 mA, 5 V dc. The instrument requires at least 100 milliseconds to recognize a change in contact status.

Set points (four set points available)

- Main Set Point (SP)
- Auxiliary Set Point (SP2)
- Auxiliary Set Point (SP3)
- Auxiliary Set Point (SP4)

SET POINT TRANSFER

Transfer from set point to set point is by logic input (contact closure). Transfer can be accomplished either by a step or a ramp with two different configurable rates of change (ramp up and ramp down).

SET POINT LIMITS

Set point low limit and set point high limit are configurable.

Control Action

PID, SMART Auto-tune, or Time Proportional Control

PROPORTIONAL BAND

Configurable from 1.0% to 200.0% of the input span. Setting a PB equal to 0 sets the control action to ON/OFF.

INTEGRAL TIME

Configurable from 1 second to 20 minutes (or off)

DERIVATIVE TIME

Configurable from 1 second to 10 minutes (or off)

Noise Immunity

The instrument conforms to EEC 89/336 directive regarding electromagnetic compatibility.

EMISSIONS

Generic emission standard EN 50081-2
Basic emission standard EN 55011

IMMUNITY

Generic immunity standard EN 50082-2

- Electrical discharge requirements: Severity Level 3 (per IEC 801-2)
- Electrical fast transient/burst requirements: Severity Level 3 (per IEC 801-2)
- Radiated electromagnetic field immunity between 27 MHz - 1000 MHz, 10 V/m (per IEC 801-3)

Optional Auxiliary Power Supply for Transmitters

Non-isolated 24 V dc (±10%) power supply rated at 25 mA, short circuit protected

718TS Specifications

Control Outputs (Three Output Types Standard)

TYPE
Three-wire servomotor drive (with potentiometer feedback) or time proportioning

DIRECT/REVERSE ACTION
Keyboard configurable

OUTPUT LEVEL INDICATION
The instrument separately displays valve position, or the Output 1 level (heating) and the Output 2 level (cooling).

OUTPUT STATUS INDICATIONS
Two LED indicators are lit when their respective output is on.

OUTPUT LEVEL LIMITS

- For 1 control output: From 0 to 100% of the output span
- For 2 control outputs: From -100 to +100% of the main (heating) output span

This function can be made active at instrument startup for a configurable time, and it can be left active in order to avoid thermal shock or preheating.

RELAY OUTPUTS OUTPUT CYCLE TIME
Configurable from 1 second to 200 seconds

OUTPUT 1
2 relays interlocked (Open/Close), with SPST contacts (NO)
Contact Rating
3 A at 250 V ac on a resistive load
Function
Programmable as:
– Servomotor output
– 1 time proportioning output

OUTPUT 2
1 relay, with SPST contacts (NO)
Contact Rating
3 A at 250 V ac on a resistive load
Function
Programmable as:
– Time proportioning output (only if Output 1 is also time proportioning)
– Alarm 1 output

OUTPUT 3
1 relay, with SPST contacts (NO)
Contact Rating
3 A at 250 V ac on a resistive load
Function
Programmable as Alarm 2 output and Alarm 3 output (logically ORed)

Servomotor Control
The servomotor output can be used as a closed loop output with feedback potentiometer or as an open loop output with or without valve position indication. The relay outputs are interlocked and can be configured as either reverse or direct acting. Contacts for these relays are rated at 3 A/250 V ac.

Time Proportional Control
OUT 1 can alternately be used as a time proportioning output.

Control Action
SMART PID Servo with potentiometer feedback or time proportional control

PROPORTIONAL BAND
Configurable from 1.0% to 200.0% of the input span. Setting the PB equal to 0 sets the control action to ON/OFF.

INTEGRAL TIME
Configurable from 1 second to 20 minutes (or off)

DERIVATIVE TIME
Configurable from 1 second to 10 minutes (or off)

Logic Inputs
The 718TS is equipped with three logic inputs:

- Logic Input 1 is used to select between set point 1 or 2
- Logic Input 2 is used to select between Auto/Manual or Rev/Dir
- Logic Input 3 is used to select between local or remote control

For logic inputs, use an external contact with a contact rating of at least 0.5 mA, 5 V dc. The instrument requires at least 100 milliseconds to recognize a change in contact status.

Feedback Potentiometer

RANGE
From 100 to 10.000 Ω

MODEL CODES

718TC- = 4-Digit Temperature Controller with Universal Input and Local Set Point

Outputs
71= 1 mA Output, 3 Relays, 2 Digital Inputs, and Auxiliary Power Supply for Transmitters

Communication
2 = No Communication
3 = RS-485 Modbus Communication

Power Supply
3 = 100 to 240 V ac
5 = 24 V dc

Example: 718TC-7135

DDE Interface to Windows applications: use with Windows version 3.10 or higher. Order Part No. 20AATZA.
Configuration Software: use with MS-DOS 5.0 or higher. Order Part No. 20AATZD.

718TS- = 4-Digit Temperature Controller with Universal Input and Local Set Point

Outputs
21= 1 Servomotor and 3 Relays

Communication
2 = No Communication
3 = RS-485 Modbus Communication

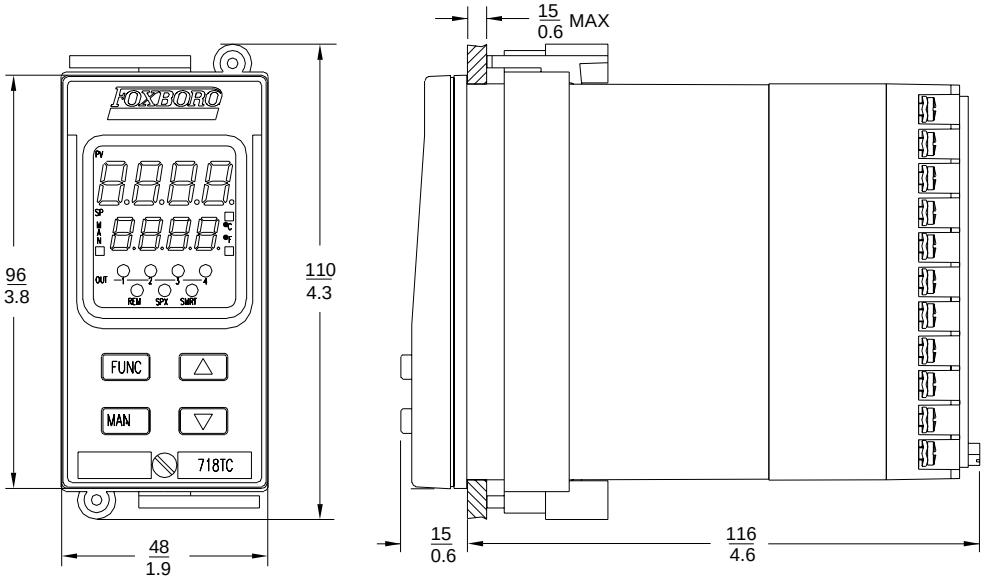
Power Supply
3 = 100 to 240 V ac
5 = 24 V dc

Example: 718TS-2135

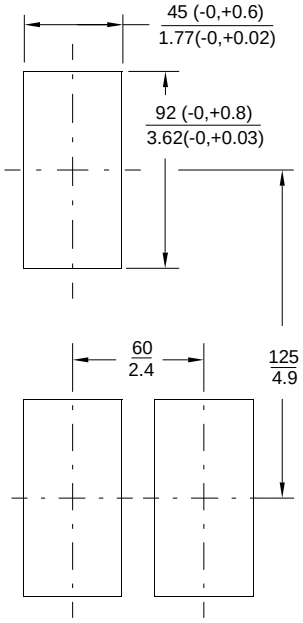
DDE Interface to Windows applications: use with Windows version 3.10 or higher. Order Part No. 20AATZA.
Configuration Software: use with MS-DOS 5.0 or higher. Order Part No. 20AATZD.

DIMENSIONS - NOMINAL

mm
in

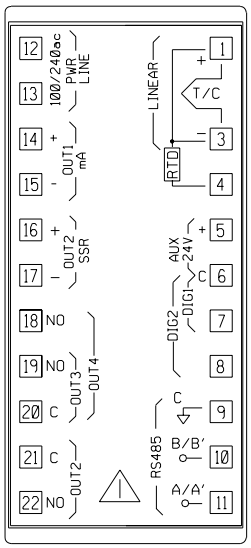


PANEL CUTOUT DIMENSIONS

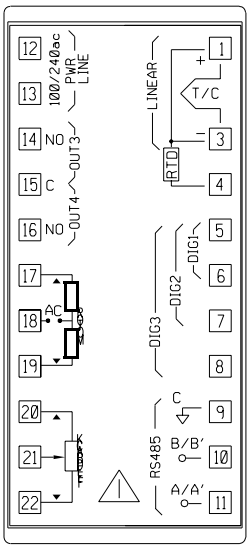


TERMINAL CONNECTIONS

718-C



718T-S



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MB 010 Printed in U.S.A. 1196